# 2006 RESEARCH PROBLEM STATEMENT

**Problem Title:** Stone Column Treatment with Wick Drains in Silty Sands  No.: 06.07-6

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**1. Briefly describe the problem to be addressed:**

Conventional wisdom indicates that stone column treatment is not effective when fines contents exceed 20%. Nevertheless, many potentially liquefiable soil profiles have fines contents greater than 20% and must be mitigated in some way. Recent experience suggests that wick drains may facilitate drainage and allow improvement with stone columns for these soils; however, procedures for quantifying the degree of improvement and desirable drain spacing are poorly developed. In addition, some case histories have shown that wick drains may not always guarantee success. No guidelines are currently available to indicate conditions when drains might be ineffective. A critical evaluation of available case histories and relevant results from lab testing and computer analyses is needed. This study should define conditions where drains will or will not improve stone column efficiency and quantify the degree of improvement that might be expected. Recommendations from this study will be particularly useful for upcoming design projects where stone column mitigation of liquefaction hazard will likely be necessary.

Strategic Goal: ☐ Preservation ☒ Operation ☐ Capacity ☒ Safety (Check all that apply)

**2. List the research objective(s) to be accomplished:**

1. Develop curves to predict final blow count as function of initial blow count and column spacing for silty sands with and without drains

2. Identify conditions which will limit the effectiveness of stone column treatment with wicks

3. Develop recommendations regarding design of stone columns in silty sands

**3. List the major tasks required to accomplish the research objective(s):** Estimated person-hours

1. Collect case histories involving stone column treatment of silty sand with and without wick drains.
2. Collect field data if cooperation and coordination can be obtained with UDOT project contractor.
2. Perform statistical analysis to evaluate improvement relative to fines content, initial blow count, drain spacing, etc.

3. Develop design curves identifying improvement with and without drains
4. Identify factors which significantly inhibit improvement and effectiveness of drains.
5. Develop design recommendations regarding use of stone columns treatment in silty sands
6. Prepare final report.

**4. Outline the proposed schedule (when do you need this done, and how we will get there):**

The project will be carried out over a one-year period. Geotechnical specialty contractors will be contacted for information. Hayward-Baker has already agreed to provide data from five projects involving use of wick drains with silty sands. Information from other contractors and government agencies (USBR) will be solicited. Collect field data if cooperation and coordination can be obtained with UDOT project contractor (schedule to be determined). Data collection and synthesis should take about 3 months. Analysis and development of recommendations will occupy another 6 months and the final recommendations and report will be completed in the last 3 months.

**5. Indicate type of research and / or development project this is:**

Large: ☒ Research Project ☐ Development Project
**Small:** ☐ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative ☐ Other _____

**6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?**

University research team working in collaboration with the UDOT geotechnical group

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)

Report which provides curves for predicting improvement based on soil properties and column spacing along with recommendations detailing when drains are likely to be effective or ineffective.

8. Describe how will this project be implemented at UDOT.

Workshop on report and recommendations will be provided to UDOT engineers and consultants. The design curves and recommendations can also be included in UDOT geotechnical design manual. These results will be a significant aid to engineers working on liquefaction hazard mitigation for upcoming road projects.

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.

Stone column treatment using wick drains has the potential for making liquefaction hazard mitigation possible for sites with high fines contents where conventional methods would be ineffective or extremely expensive. These cost savings would reduce UDOT design and construction costs.

10. Describe the expected risks, obstacles, and strategies to overcome these.

Limited test results may make it difficult to draw firm conclusions. Some additional soil testing may be necessary at some of the sites.

11. List the key UDOT Champion of this project (UDOT employee who will help Research Division steer and lead this project, and will spearhead the implementation of the results): Jon Bischoff and Darin Sjoblom

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): $30,000 (additional cost associated with field data collection to be determined).

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

| Name | Organization/Division/Region | Phone |
|---|---|---|
| A) Brad Price | RBG Engineering, Provo, Utah | 374-5771 |
| B) Jim Higbee | UDOT/Geotechnical Group/Complex | 965-4351 |
| C) Roberto Lopez | Hayward Baker, Santa Paula, California | 925-825-5056 |
| D) Mathew Francis | URS Consultants, Salt Lake City, Utah | 808-551-8006 |
| E) | | |
| F) | | |
| G) | | |

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study:

Hayward-Baker, Inc., USGS, USBR.